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STAMEN-NUMBERS IN CUPHEA

WILBUR H. DUNCAN

WHILE studying a collection (*W. H. Duncan* 10659, 26 October, 1949, Clayton Co., Ga.) of several plants of *Cuphea* I observed considerable variation in the number of stamens, even on a single plant. Literature immediately available to me indicated that in our United States species there is disagreement as to the number of stamens and that no detailed studies had been made on this subject. My studies of plant-material and literature were then carried farther, including a trip¹ to the Gray Herbarium, Cambridge, Massachusetts.

Cuphea is a large American genus of over 200 species. Four species occur in eastern United States, at least one more (*C. wrightii* Gray) in southwestern United States, and many species in Mexico, Central America and South America. Three of those occurring in the United States [*C. procumbens* (Cav.) Small, *C. asper* Chapm., and *C. carthagenensis* (Jacq.) MacBride] are confined to the southeastern United States. Only one species, *C. petiolata* (L.) Koehne [*Parsonsia petiolata* (L.) Rusby, *Cuphea viscosissima* Jacq., *C. viscosissima* Willd. sensu Pursh 1816], has a wide distribution in the United States (Georgia to Louisiana, Kansas and New Hampshire).

Variation from a few to many stamens occurs in the *Lythraceae* of which *Cuphea* is a member. Stamen-numbers in *Cuphea* are mostly 11 but vary from 6 to 14. In our United States species the stamens are probably 11 except for some variation in *C.*

¹ Supported by a grant through Dr. George H. Boyd, Dean of the Graduate School, University of Georgia.

petiolata. Various authors apparently disagree concerning the number in this species. Other authors do not mention the number of stamens. For example, Michaux (1803), Elliott (1821), and Robinson & Fernald (1908) give no stamen-numbers. Pursh (1816), under *C. viscosissima* Willd., says "floribus 12-andris". Torrey & Gray (1840) say "stamens 12" for this species, while Torrey (1843) gives no number but lists "Stamens about 12, unequal" for the genus. Britton (1901) indicates that there are sometimes 12 stamens in *C. petiolata*. Britton & Brown (1913) agree. Small (1933) actually uses "stamens 12" in keying out this species from the closely related *C. procumbens*, which he says has 11 stamens.

A thorough study of the genus was made by Koehne (1903). On page 85 in the Key to Sections, under Sect. 9. *Heterodon* Koehne, which includes *C. petiolata*, the stamens are listed as "11, alterne inaequalia". On the basis of a survey of the literature alone, therefore, it would appear that *C. petiolata* usually possesses 11 stamens but in some instances 12.

A brief analysis of herbarium material of *C. petiolata* yielded interesting results. Four flowers on one plant, from each of eight separate collections from seven states, were dissected and variation in size and number of stamens was recorded. The collections are from Washington Co., Tennessee; Rabun Co., Georgia; Franklin Co., Indiana; Davis Co., Iowa; Upshur and Cabell Cos., W. Va.; Allegheny Co., Pa., and Chain Bridge, Virginia. Although the stamens are uneven in size the differences are not pronounced and there are 11 stamens in each of the 32 flowers. These data certainly do not indicate that there are sometimes 12 stamens. The possibility that another species is involved was considered. This possibility is dismissed as being improbable, since all other characters agree well with those assigned to *C. petiolata* by several authors.

Four flowers from each of thirteen unmounted plants from the Clayton County, Georgia, collection were dissected and variation in size and number of stamens was recorded. The resulting data are given in TABLE 1. It may be seen that the number of stamens varies from 5 to 11, sometimes even on the same plant and that a pronounced reduction in size of some of the stamens is of frequent occurrence. Out of the 52 flowers dissected on the 13

plants 25 have 11, 10 have 10, 9 have 9, 3 have 8, 3 have 7, 1 has 6, and 1 has 5 stamens. Thus more than half of the flowers have 10 stamens or less. I shall not attempt to bring out the significance of this variation. It should, however, be emphasized that less reliance taxonomically should be placed on the number of stamens in *C. petiolata* than has been done by such authors as Pursh (1816), Torrey & Gray (1840), and Small (1933).

Plant No.	No. stamens	Notes on size of stamens
1	11-10-10-9	none
2	11-11-11-9	none
3	11-11-11-10	none
4	11-11-7-5	none
5	11-11a-10-9	(a) 3 much reduced
6	11-11-11b-9	(b) 3 much reduced
7	11-11-11-11c	(c) all 11 reduced equally
8	9-8-7-7	none
9	11-11-9-9	none
10	11-10-9d-6	(d) one, no anther; 2 fused
11	11-11-10-10	none
12	11-10-9e-8	(e) 6 much reduced
13	11f-10-10-8	(f) 2 reduced

TABLE 1. Numbers of stamens and notes on their sizes in four flowers on each of thirteen different plants in a collection of *Cuphea petiolata* from Clayton Co., Georgia.

Additional studies on stamen-numbers in *Cuphea* should be made. Although additional herbarium-material was available to me, dissections were not made because of the damage to the specimens that would have resulted from the dissection of a number of flowers on each plant. Persons collecting *Cuphea* might well keep this problem of stamen-numbers in mind and when possible collect adequate material for study. I would be happy to accept for study future United States collections that contain sufficient material for dissection-studies.

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A KEY TO THE HICKORIES NORTH OF VIRGINIA
 WITH NOTES ON THE TWO PIGNUTS,
CARYA GLABRA AND *C. OVALIS*

WAYNE E. MANNING

THERE are a number of good books which are useful in the identification of hickories, such as Gray's Manual, N. L. Britton and A. Brown (*Illustrated Flora of Northern States and Canada*), C. S. Sargent (*Manual of the Trees of North America*), A. Rehder (*Manual of Cultivated Trees and Shrubs*), J. S. Illick (*Pennsylvania Trees*), C. C. Deam (*Trees of Indiana*), C. C. Deam (*Flora of Indiana*), C. H. Otis (*Michigan Trees*), W. M. Harlow and E. S. Harrar (*Textbook of Dendrology*), W. M. Harlow (*Trees of Eastern U. S. and Canada*), A. F. Blakeslee and C. D. Jarvis (*Trees in Winter*), R. J. Preston Jr. (*North American Trees*) and others, many of them illustrated. The winter buds are best illustrated in Illick (the enlarged drawings), Blakeslee and Jarvis, Deam (*Trees of Indiana*), Harlow and Harrar, Harlow, and A. O. Huntington (*Studies of Trees in Winter*). The best characters for separating the hickories are the mature fruit, winter terminal buds, mature leaves, and bark of the trunk; these are represented only on fruiting older trees in the fall. With these features all present it is possible to name all of the hickories quite definitely. The books mentioned above rightfully base their separations on these features, with special emphasis on fruit. The best modern treatments or keys for *Carya*, with the latest names for the species, are in Sargent, Deam, Harlow and Harrar, Harlow, and Preston. The descriptions and illustrations of *C. glabra* and *C. microcarpa* in Otis both apply to *C. ovalis*, but the twigs should not be described as hairy. *C. ovalis* is not recognized by Illick. The names of 3 species of the region covered in this article have

been changed since the time of Gray's Manual, 7th edition: *C. microcarpa* is now *C. ovalis*; *C. alba* is now *C. tomentosa* Nutt., and *C. glabra* var. *villosa* is now *C. pallida* (Ashe) Engler and Graebn. for most of the eastern trees [though in part *C. glabra* var. *hirsuta* (Ashe) Ashe and *C. ovalis* var. *mollis* Ashe] and *C. texana* Buckl. with its var. *villosa* (Sarg.) Little for the western members.

The writer has found that few of the keys in the books mentioned above are of much use for summer identification or for herbarium specimens. The key given below is intended primarily for this purpose and consequently emphasizes vegetative features; other features are, however, added, so these may be used where present. The principal contributions of the key are the emphasis on bud-scale-scars in *Carya cordiformis*, and that on the tufts of hairs on the serrations in *C. ovata*; an attempt is also made to show the difference in hairiness between different species. Only a few of the varieties of the species are treated, these being primarily the ones based on vegetative features. To simplify the key, the southern and western species of the Gray's Manual range are not included, namely *C. illinoensis*, *C. aquatica*, and *C. texana* Buckl. (*C. Buckleyi* Durand, the western representative of *C. glabra* var. *villosa* of Gray's Manual, 7th ed.). Consequently this key covers primarily the region from Ohio and Michigan to New Jersey and Maine.

The range of variation in features in each species of *Carya* is well known. This applies to the number of leaflets, the stoutness of the twigs, the hairiness of leaves and twigs, and size of fruit, so that all of these features must be used with care. The difference in stoutness of twigs and in size of terminal buds varies tremendously in the same tree from strong terminal twigs to short lateral twigs; unfortunately most herbarium specimens are made from the latter. In all species treated here individual trees may be found with seven leaflets. The writer has found of little value the relative size of the terminal leaflet or upper leaflets with respect to the lower ones, and the presence or absence of serrations at the base of terminal leaflet (the latter used in some books for *C. tomentosa*).

Certain notes are necessary. The pseudoterminal bud, which is a lateral one appearing as a terminal one especially on fruiting

shoots, must not be confused with a true terminal bud, as it differs both in size and in type of outer bud-scales. On these fruiting twigs, the scar of the fruiting tip of the twig can be found on the side of the bud opposite the uppermost leaf-scar. In all of the species of the section *Eucarya* (all species in the region covered except *C. cordiformis*) there are present on the true terminal bud outer dark brown coriaceous slender-tipped scales in summer, so during this season the terminal bud is not distinctive for a given species; the terminal bud is, however, elliptical, more elongate and comparatively slender in *C. ovata* and *C. laciniosa*, and subglobose to oval in the other species; there is some uncertainty, however, about the shape of the bud in *C. glabra*. These outer bud-scales fall off in late autumn or early winter in all species except *C. ovata* and *C. laciniosa*, exposing the silky inner scales or sometimes the blunt inner coriaceous scales (*C. glabra*?). At this time the terminal bud on a strong shoot is one of the best features in the genus.

The tufts of hairs on the leaflet-serrations, which the writer finds one of the best characters in *C. ovata*, varies from spring to fall in the same tree, and differs in younger trees from that in older trees, and varies from tree to tree in conspicuousness. The tufts on a typical tree during the summer are quite striking, there being a dense tuft of hairs on one or both sides of the apex of the serration, frequently arising from a slight indentation or pit along the margin of the serration. In the spring the margin of the serration is densely ciliate, with fascicled or solitary hairs, so that the tuft is not distinct as such, but the hairs are much more crowded near the apex, so it is evident that a tuft is there. The ciliation below the tuft gradually or rapidly disappears during the season. By fall many of the tufts themselves have, of course, worn off; it is, therefore, necessary sometimes to examine a large number of serrations to locate a characteristic tuft; since, however, these do not occur in other species, one such tuft is sufficient to identify the species. In the field the writer has always found some or all of the leaves of a tree with characteristic tufts; in herbarium specimens some tufts are usually present, but in examining a very large number of specimens the writer has found a few specimens, presumably *C. ovata* because of typical buds or fruits, in which tufts were not located; it is probable that some

other leaves on the tree may have had tufts, but this requires further study. On a very young tree, or sometimes on weakly developed short branches from the main trunk, the serrations may be uniformly ciliate, the hairs scattered as in other species. There is, thus, some possible source of error under the conditions indicated, especially in poorly collected specimens.

The term fascicle of hairs (or fascicled hairs), used by Sargent and others, is adopted in place of the term cluster of hairs or a stellate hair for the group of four to six hairs arising from one point, so characteristic of the leaves for many species of *Juglans* and *Carya*; in some books leaves with fascicled hairs are described as tomentose. The fascicle probably arises from one cell of the epidermis, so morphologically this might be considered a branched hair, rather than a cluster of hairs, but the appearance is definite. These hairs are one-celled and pointed, as are also the paired ones and most solitary ones in *Carya*. Gland-tipped solitary hairs, common in *Juglans*, are scarce and not characteristic of mature foliage in *Carya*, though short ones are sometimes present on very young foliage; these hairs have cross-walls and are thus several-celled. In the Juglandaceae the lower surfaces of the leaflets are glandular-scaly or lepidote because of the few to numerous sessile flat round glands or scales; leaves with only this covering are considered glabrous, as these are not true hairs.

Most of the species of *Carya* in the northeast are fairly constant and relatively easy to identify with good material, except for the two pignuts. To be sure, many of the specimens in the principal herbaria are incorrectly named, and the writer himself had difficulty in separating *C. ovata* from *C. ovalis* and *C. glabra* until he started using the tufts of hairs on the serrations on the leaflets in the first species. The teeth of *C. ovata* are usually dentate-serrate, those of *C. ovalis* and *C. glabra* are usually serrate or even incurved-serrate; this difference is not too definite, and not always constant and hence is not given in the key.

The two pignuts, *C. ovalis* and *C. glabra*, are the most difficult of all species in the northeast to separate. The writer has been unable to separate these except with completely mature fruit collected in November. Furthermore many trees have fruit intermediate between the species in various ways. It is possible that these two constitute but one variable species, an interpreta-

tion which was held in the United States about 50 years ago and which is still held by some good modern botanists; the differences might then be considered at least in part ecological. But the extremes are so definite that it seems to the writer best to consider them as two separate species, which are so recently evolved that hybrids between the two are very common. It is significant that the hickories of many hillsides and upland pastures are essentially pure stands of typical *C. ovalis*, but where one to several trees of *C. glabra* are found with *C. ovalis*, then intermediates (hybrids) are frequent. The writer has seen a number of both types of localities. In the writer's experience *C. ovalis* is more common on dry exposed upland hillsides, *C. glabra* more frequent in the valleys along streams or on less exposed hillsides, but both species may occur in both habitats. It is possible that if enough typical trees of both species are studied, excluding the intermediates, other features of bud and leaf may be found. Herbarium specimens lacking fruit, then, cannot be named definitely, though the features of leaf and bud given in the key are sometimes distinctive.

With reference to the hairy-leaved trees of the pignuts the same relative statements may be made. The pure stands of *C. ovalis*, however, seem to have completely glabrous leaves (possibly some tufts of hairs in the axils of side veins along the midribs of the leaflets), and hairy-leaved trees seem to appear only where *C. glabra* occurs alone (no such location definitely seen by the writer) or where *C. glabra* and *C. ovalis* occur together. This has led the writer to believe that *C. glabra* is the more commonly hairy of the two species, and he has now decided to adopt the name *C. glabra* var. *hirsuta* (Ashe) Ashe, not *C. ovalis* var. *hirsuta* (Ashe) Sargent, the latter name based on the same original *Hicoria glabra* var. *hirsuta* Ashe. Ashe, in his description of *H. glabra hirsuta*, var. *nov.*, in, Notes on Hickories 1896, described only the leaves, the full description reading: "Leaflets thicker; petioles and lower surface of leaves tomentose. North Carolina to Alabama." He did not describe the fruit specifically, but his name, combined with the facts that he recognized *C. odorata* (now *C. ovalis*) and its var. *villosa*, and that the trees with characteristic fruit of *C. glabra* are common in the mountains of North Carolina as illustrated by collections by Harbison at the Arnold Arboretum, indicate that

the original name of Ashe should stand. Sargent, in *Botanical Gazette*, vol. 66, 1918, p. 247, states that the fruit is pyriform, usually narrowed below into a short stipitate base, usually opening only to the middle, but considers this a variety of *C. ovalis* because of the scaly bark. Ashe's original description of the tree seems not to mention the bark, as his description is separated (with that of *H. pallida*) by a blank line from the descriptions of the scaly-barked hickories (*H. ovata*, *H. carolina-septentrionalis*, *H. borealis*, *H. odorata* and its var. *villosa*). Harbison has few notes on the bark on the herbarium labels, though on his no. 3 from Highlands, N. C. he indicates bark flaky with narrow thick plate-like scales. Furthermore, many of the trees in the northeast observed by the writer do not have scaly bark, even on those trees whose fruit is intermediate between that of *C. glabra* and that of *C. ovalis*. Unfortunately, there is no type of *H. glabra hirsuta* in the Ashe herbarium at the University of North Carolina; the writer is not at present ready to designate a lectotype. Harbison's collections from North Carolina and Georgia at the Arnold Arboretum, some of these referred to by Sargent in his article in *Botanical Gazette* mentioned above, are quite diverse in fruit. Horsey 2062, from Gallipolis, Gallia Co., Ohio, at Arnold Arboretum, has a typical fruit of *C. glabra* with essentially indehiscent husk. The writer is including in the variety all hairy-leaved trees of *Carya glabra*, including those specimens with hairy rachises, those whose leaflets are hairy on the lower surfaces, and those with hairs on both locations (this does not include specimens with hairs only in the axils of the side veins along the midribs of the leaflets). The amount of hairiness varies from tree to tree, or it is sometimes greater on the leaves of the lower branches of a tree than on its higher branches; sometimes the type of hairiness varies, the hairs on the rachis ranging from very minutely puberulent to clearly pubescent, in rare cases the hairs being in fascicles on the rachis as in *C. tomentosa*. In general, as stated in a previous article (*RHODORA*, vol. 47, 1945, pp. 46-47) and in the key below, the two hairy pignuts are separated from *C. tomentosa* and *C. pallida* by their having the hairs densely crowded on the rachis, with both solitary and fascicled hairs, instead of having evident separated fascicles of curly hairs. Frequently the hairs are restricted to the rachis just below the attachment of the upper three leaflets.

For the hairy-leaved trees of *Carya ovalis* the writer is now adopting the name of *C. ovalis* var. *mollis* Ashe (RHODORA 25: 180, 1923). Unfortunately again the writer has found no type for this variety, described from dry crests of ridges, Twin Creeks, Adams County, in southwestern Ohio, and must base the variety on the description alone ("Having the fruit of the type and with its red petioles and large leaflets, but the leaflets soft pubescent beneath"). The writer has studied few Ohio collections and has seen few hairy pignuts from that state. The writer is not yet ready to select a lectotype. The following specimens, collected by the writer and located in the herbarium of the writer at Bucknell University, have hairy rachises or leaflets and have fruit 3-4-ridged to base, close to characteristic *C. ovalis*: trees marked f, i, B, G, H, Meeting House Hill, Winchester, N. H.; trees marked G, Z, Burt Pitt Road, Northampton, Mass.; tree no. 2, North Farms, N. of Florence (Northampton) Mass.; bank of Paradise pond, opposite Burton Hall, Smith College, Northampton, Mass. On some of the specimens the hairs on the lower surface of the leaflets are mostly in fascicles as in *C. tomentosa*, and this might suggest a hybrid origin for the tree. In many localities observed by the writer, however, where the hairy pignuts are found, *C. tomentosa* is absent in the vicinity; there is, furthermore, no indication of a hybrid origin in the twig, bud, bark, leaflet-size, fruit-size, husk-type, or nut. As in *C. glabra* var. *hirsuta*, the hairs of *C. ovalis* var. *mollis*, as interpreted by the writer, may occur on the lower surface of the leaflets, on the rachis, or on both areas.

Trees with fruit intermediate between *C. glabra* var. *hirsuta* and *C. ovalis* var. *mollis* are almost as frequent as the characteristic trees; these the writer considers as natural hybrids, but is not proposing a name. In addition to these confusing trees, true hybrids between *C. glabra* or *C. ovalis* and *C. tomentosa* do undoubtedly occur.

The writer regrets that it seems necessary to break up the hairy pignuts into varieties under two different species as given above, as this means that it will be impossible to name sterile material, and difficult to clearly name many fruiting specimens.

Harlow and Harrar (Textbook of Dendrology, 1941, pp. 276-279) and others have recently questioned the range of *Carya*

ovalis and of *C. glabra* in New England. The writer has examined material collected by himself and specimens at Gray Herbarium and at Arnold Arboretum and has located characteristic fruiting specimens of *C. ovalis* in at least ten counties of Massachusetts and in at least two counties in southern New Hampshire. He has not checked the records for Vermont reported by Blakeslee and Jarvis (New England Trees in Winter) and others, and there is some uncertainty about the species represented. *C. glabra*, although scattered through much of Massachusetts, is very much less common both in this state and in most of New England, and is frequently represented by hybrids with *C. ovalis*, so that a sterile specimen of a pignut in New England is likely to be *C. ovalis*. This is also the opinion of Ernest J. Palmer, formerly of Arnold Arboretum, and one of the foremost students of *Carya*.

As indicated by the writer in RHODORA, Vol. 47, 1945, pp. 46-47, the two hairy pignuts (there treated as one, *Carya ovalis* var. *hirsuta*) range from southern New Hampshire and central Massachusetts through New York, Ohio, Pennsylvania, New Jersey, Kentucky, south through the Allegheny Mountains to North Carolina. The writer has seen perhaps 125 sheets of hairy pignuts, many of these sterile, many with fruit intermediate between the two species; the specimens studied were largely in the herbaria of Arnold Arboretum, University of Pennsylvania, and the writer. Detailed distribution of each species, with citation of specimens, is impossible at present until more fruiting material is collected.

It might be of value to summarize, independent of the key, the principal vegetative features which the writer finds most useful for recognizing each species in the herbarium and in the field. Brief notes on the three species omitted in the key from the Gray's Manual region are added.

C. CORDIFORMIS, 7-11 leaflets; bright yellow bud; separated bud-scale-scars.

C. OVATA, usually 5 leaflets, special tuft of hairs on the serrations; outer bud-scales of terminal bud persistent.

C. TOMENTOSA, 7-9 leaflets; separate curly fascicles of hairs on lower surfaces of leaflets, on rachis, and frequently on twig; outer terminal bud-scales deciduous.

C. LACINIOSA, 7-9 leaflets; twig tan-colored; hairs present on

lower surface of leaflets and frequently on twig; outer bud-scales persistent.

C. PALLIDA, leaflets 7-9; scattered fascicles of curly hairs present on some of rachises and also on midribs of leaflets beneath, but absent on lower surface of leaflet proper (contrary to statement in Sargent's Manual); pale glands common on lower surface of leaflets, especially in the spring; twigs in our region not hairy.

C. GLABRA and *C. OVALIS* together, leaflets 5 or 5-7; no special subapical tufts of hairs on serrations; rachis glabrous or if hairy the hairs crowded, not clearly in fascicles; lower surface of leaflets glabrous or sometimes hairy; twigs not hairy; glands on lower surface of leaflets small and dark, though variable; outer bud-scales of terminal buds deciduous in late fall so buds gray-silky or sometimes covered by dark blunt scales.

C. ILLINOENSIS, similar to *C. cordiformis*, but leaflets mostly 11-13, strongly falcate as opposed to rarely falcate; buds rarely bright yellow, at least the terminal strongly hairy as opposed to glabrate; upper leaflet and sometimes lateral ones stalked, not sessile (terminal leaflet in *C. cordiformis* rarely short-stalked), serrations usually prominent; venation of leaflets much as in *C. cordiformis*, the side veins not crowded, branching rather freely near the tips, the branches usually curving downward and usually going directly to the center of the serration.

C. AQUATICA, similar to *C. illinoensis*, but with mostly 11 leaflets, strongly falcate, usually narrow, the terminal stalked; serrations usually very inconspicuous; side veins of leaflets usually crowded (usually about 30 pairs in total), about one to a tooth, rarely branching at the tips, many of them ending at the sinus.

C. TEXANA Buckl. (*C. Buckleyi* Durand), similar to *C. pallida* or *C. ovalis*, with 5-9 leaflets, rachis and twig sometimes fascicled-hairy, the leaflets with numerous red scales in the spring.

1. Bud-scales valvate, the one to three pairs of bud-scale-scars comparatively high and separated; stalk of the bud forming a collar at the base of the new growth of lateral shoots, these often pseudoterminal; buds yellow, rather flattened; bud-scales not accrescent or but slightly so; leaflets commonly lanceolate or oblong-lanceolate, sometimes falcate, 7-11, never 5 only; some or all of clusters of staminate catkins on short, special, essentially leafless side shoots on old wood; nut very thin-shelled, the primary septa and usually the internal secondary ribs of the nut-shell with dark brown powder-filled cavities (lacunae); seed very bitter, with ruminating endosperm; (serrations without tufts; bark not exfoliating; husk thin, splitting only $\frac{1}{2}$ way to base). *C. cordiformis*.
1. Bud-scales imbricate, their several to many scars consisting of very many confluent lines forming a definite, usually ciliate, ring of bud-scale-scars; bud-stalk collar usually absent; mature buds brown or gray, though bud-scales often with scattered yellow glands; bud-scales strongly accrescent in spring; leaflets 5-9, lanceolate to obovate, not falcate; staminate catkins only at the base of elongate leafy shoots, these terminal and sometimes also lateral; nut rather thick-shelled,

without dark powder-filled cavities in septa or secondary ribs; seed sweet or essentially so; (bark and husk various).

2. Margins of leaflets strongly ciliate when young, each serration with a persistent dense tuft of hairs on one or both sides of the tooth just below its apex, many of the tufts wearing off on some of the leaflets by autumn; leaflets typically 5 only (trees with 7 leaflets extremely rare); (branchlets reddish-brown or olive, usually stout; this year's twig usually pubescent; terminal bud elongate, 10-27 mm. long, the outer dark brown coriaceous bud-scales persistent, the outermost usually hirsute with narrow tips; bark shaggy, the loose pieces typically long and broad; husk thick, splitting to base, hence ovary 4-ridged to base; nut strongly angled)....3

3. Mature twigs, petioles, rachises, lower surfaces of mature leaflets lightly pubescent to glabrate; hairs on leaflets mostly solitary or in pairs....*C. ovata* and varieties *Nuttallii*, *fraxinifolia*, *borealis*, *complanata*, *ellipsoidalis*

3. Mature twigs, petioles, rachises, and often lower surfaces of mature leaflets strongly villous; hairs of leaflets commonly in fascicles, though mixed with other types.....

.....*C. ovata* var. *pubescens*
2. Margins of leaflets sometimes ciliate when young with fascicles of hairs, but serrations without special dense subapical tufts of hairs; leaflets 5-9; leaflets and rachises of those species having only 5 leaflets typically glabrate, the margins not ciliate, the twigs rather slender and glabrous, and the outer bud-scales deciduous in autumn; (bark, husk, and ovary various)....4.

4. Branchlets slender; surface and side veins of lower sides of leaflets typically glabrous (sometimes hairy in the infrequent *C. glabra* var. *hirsuta* and *C. ovalis* var. *mollis*); terminal bud short, 5-12 mm. long; twigs of the year glabrous, the branchlet or twig in autumn reddish- or chestnut-brown; leaflets 5 alone on some trees of two species, 5-9 in others, the margins commonly glabrous or glabrate; husk thin, 1-4.5 mm. thick; nuts usually not strongly angled; (leaves small to medium, mostly 6-14 inches long; mature outer dark brown coriaceous bud-scales early deciduous)

5. Rachises of some or all of leaves shaggy with definite separated fascicles of often curly hairs, sometimes becoming glabrate; leaflets 7-9, usually narrow, pale beneath, usually glabrous except sometimes on the midribs, densely glandular-dotted beneath when young with pale glands, some of these often persisting; buds and tips of twigs with few to many prominent light yellow glands; husk 3-4.5 mm. thick; (bark ridged; husk splitting to base along at least 2 sutures; S. N. J. to Ala.)....*C. pallida* (*C. glabra* var. *villosa* of Grays Manual 7th ed. in part)

5. Rachises varying from glabrous (the common condition) to densely pubescent (in the latter case the hairs usually solitary or in pairs, or sometimes in fascicles mixed with other types, not curly); leaflets 5-7, glabrous or sometimes hairy, not pale beneath, with scattered small glands; husk 1-3 mm. thick....6.

6. Mature husk warty, dull, light brown, splitting to base along 3-4 sutures, hence ovarian ridges, sometimes obscure, reaching to base

of ovary; stipe rarely present; leaflets commonly 7, or 5 and 7, or on some trees 5 only, typically ovate to obovate, or oblanceolate, thick, petiole frequently red; buds ovate, typically blunt or merely acute, the tips of the narrow outer deciduous bud-scales frequently villous; bark of trunk scaly or even shaggy, or scaly only in younger portions and ridged at base or on some trees without scaliness; nut shell thin, frequently angled above....7.

7. Rachis, petiole, lower leaflet surfaces glabrous or essentially so.....

.....*C. ovalis* vars.

typica, obcordata, obovalis, and odorata

7. Rachis, and often petiole and lower surface of leaflets densely pubescent (fruit sometimes with a stipe, and splitting along only 3 sutures).....

.....*C. ovalis* var. *mollis*

6. Mature husk smooth, shining, dark brown, splitting only at apex or to middle or sometimes later along one suture to base; stipe often present so fruit pear-shaped, typically strongly flattened; leaflets commonly 5, rarely 5 and 7, commonly lanceolate, thin; terminal buds usually lanceolate, acuminate, some of the blunt coriaceous glabrate bud-scales frequently persistent in winter; bark tight, ridged below, not scaly; nut not ridged, comparatively thick-shelled....8.

8. Rachis, petiole, lower leaflet surfaces glabrous or essentially so.....

.....*C. glabra* and var. *megacarpa*

8. Rachis, and often petiole and lower surface of leaflets densely pubescent....

.....*C. glabra* var. *hirsuta*

4. Branchlets stout; lower surface of leaflets densely pubescent, most of the hairs in fascicles; mature terminal bud elongate, 10-27 mm. long; twigs of the year hairy, at least early in the season, or else branchlet or twig in autumn light orange or buff; leaflets 7-9, never 5 alone, the margins commonly ciliate, especially early in the season; husk medium to thick, (4) 5-10 mm. thick; nuts strongly angled at least above; fruit and nuts large; leaves medium to large, 8-22 inches long, the petioles usually stout; outer bud-scales deciduous or persistent; husk splitting to base or nearly so; the sutures of the immature fruit often obscured by hairs)...9.

9. Twigs or branchlets tan, buff, or pale orange (but gray on one side); hairs on rachis usually not clearly in fascicles, commonly straight, the rachis often nearly glabrous; bark shaggy; outer bark brown coriaceous bud-scales of terminal bud persistent; petioles often persistent in winter; husk very thick (Cent. N. Y. & S. E. Pa. W. & S.).....

.....*C. laciniosa*

9. Twigs reddish brown; hairs on rachis clearly in separated fascicles, curly (shaggy); bark deeply

ridged, not shaggy; outer dark bud-scales of terminal bud early deciduous, so winter buds light grayish-brown, silky-tomentose; husk medium thick; Mass. South and West *C. tomentosa* and var. *ficoides*, etc.

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THE HYBRID OF *LYSIMACHIA TERRESTRIS* AND *L. THYRSIFLORA*

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× *LYSIMACHIA commixta*, nom. nov. *L. terrestris* × *thyrsiflora* Fernald & Wiegand in *RHODORA*, xii. 141 (1910); Marie-Victorin, Fl. Laurent. 145 (1935).

This hybrid, described in 1910, is so abundant and constant in the northeastern area of the range in North America of *Lysimachia thyrsiflora* L. that it is quite as deserving of a binomial by which it can be referred to as is the mostly more southern × *L. producta* (Gray) Fernald. At its various stations it usually (or perhaps always) forms very extensive colonies exactly combining the characters of the two parents and in some cases not associated with either or both of them, just as is the case of × *L. producta*. The following collections are before me:

QUEBEC: environs d'Ottawa, Juillet 7, 1915, *Victorin*; Chateauguay, 1916, *Victorin*; grande colonie, Iles de Boucherville, Co. de Chambly, *Victorin* & *Rolland*, no. 43,148 and 44,155; Saint-Pierre-les-Becquets, Co. de Nicolet, *Victorin*, *Rolland* and *Meilleur*, no. 44,121; vers le haut de la zone intercotidale, Saint-Francois, Île d'Orleans, *Victorin*, *Rolland* and *Meilleur*, no. 44,388; swale bordering salt-marsh, Bic, Rimouski Co., *Fernald* & *Pease*, no. 25,230.

MAGDALEN ISLANDS: dune-hollow, Brion Island, *St. John*, no. 1966.

PRINCE EDWARD ISLAND: many acres in swale near margin of North Lake, Kings Co., *Fernald*, *Long* & *St. John*, no. 7935.

MAINE: many acres in boggy river-meadow, St. Croix Junction, Calais, *Fernald*, no. 2170 (TYPE in Herb. Gray.); tidal swales along Cathance River, Bowdoinham, *Fernald* & *Long*, no. 14,364.

VERMONT: swamp, abundant, Alburg, July 15, 1939, *C. H. Knowlton*; Middlebury, June 22 and Sept. 25, 1880, *Brainerd* (PARATYPE); margin of Otter Creek, Weybridge, July 15, 1938, *Knowlton*; swamp, Colchester, July 13, 1932, *Knowlton*.

NEW YORK: very wet places along the Erie Canal, 2 miles east of Utica, *Haberer*, no. 1363.

Not only is \times *Lysimachia commixta* a dominant plant where it occurs. It also has a strong tendency to invade tidal marshes. Victorin says in his *Flore Laurentienne*: "L'hybride une fois formé se multiplie végétativement par les parties souterraines et peut former des colonies". It would be instructive if those situated to do so would follow the subterranean rhizomes and stolons to determine to what extent they are actually connected. The herbarium-material at hand shows no more subterranean development than in the two parent-species, one of which, *L. terrestris*, is often reproduced vegetatively (by axillary bulblets). In fact, it is the observation of many field-botanists that large areas of floriferous *L. terrestris* will contain no bulblet-bearing plants and, reciprocally, that all or essentially all plants of other areas will be flowerless, but with abundant vegetative bulblets. In the herbarium of the New England Botanical Club 245 plants have inflorescences but no bulblets, 33 have bulblets but no inflorescences, and 9 (all in ripe fruit) have both, the bulblets produced long after the flowering period.

It is, therefore, a striking fact that none of the hybrids of *Lysimachia terrestris* nor of the species with which it has so successfully hybridized should show any suggestion of the axillary bulblets which are so characteristic of *L. terrestris* and which gave the species its name (Linnaeus, calling it *Viscum terrestre* because he mistook the moniliform bulblets to be a mistletoe parasitic on an herb). It is also a striking fact that *L. terrestris* (of § *Ephemerum*) should have produced with the utterly different and only remotely related species a blend which is dominant and usually in a habitat quite unlike that occupied by the other parent. In the case of \times *L. producta*, one parent (*L. terrestris*) is a paludal plant with opposite green ascending leaves, often bushy-branching habit, terminal racemes and axillary bulblets, the other parent, *L. quadrifolia* L. (of § *Verticillatae*), a plant chiefly of dry or dryish woodland, with purplish or reddish leaves in remote horizontal or reflexed whorls along the simple axis, and few divergent flowers from the axils. In case of the aggressively spreading \times *L. commixta*, the second parent is the single member of the unique circumboreal § *Naumburgia*, so

distinct in habit and floral structure as often to be treated as a separate genus. Some others of our native species of *Lysimachia* belong to § *Steironema*, a group of species which is often treated as a distinct genus. So far as we yet know *L. terrestris* has not crossed with members of this unique section.

Here is an alluring problem for some of the very modern students of evolution. Nature has already posed the problem. Field-study, reenforced by the newer techniques of the laboratory and the garden, should throw light upon it. Inability longer to use a microscope forces the writer to leave the question to others.

ADIANTUM CAPILLUS-VENERIS IN THE UNITED STATES

M. L. FERNALD

As I pointed out in Gray, Man. ed. 8, 48 (1950), "Our plant has longer and more slender rhizomes than the typical European plant; the various geographic vars. are not yet worked out". At the time of writing I tried in vain to "wish" the problem upon the late C. A. Weatherby, who had so far dipped into the genus as to join Maxon in describing new species from Central and South America. Now, assembling data on the affinities of the flora of temperate eastern North America, it becomes important to have a more exact picture of the situation than seems to have prevailed.

Typical *Adiantum Capillus-Veneris* was described by Linnaeus, Sp. Pl. ii. 1096 (1753) with "*Habitat in Europa australi.*" The species is now considered to be semi-cosmopolitan in warm parts of the globe ("Europa occ. et austr. Africa. Asia temp.-Himalaya. Ceylon. Queensland, Polynesia. U. S. A. merid. et occ.—Columbia-Amazonas. ? Ind. Occ."—*Christensen*). In general plants of such nearly world-wide range, within the tropical and warm-temperate latitudes, are not uniform; and, certainly, when in the western interior of the United States the species extends northward to ravines of the Black Hills, it is in an area with a relatively northern flora. It there occurs, however, at Cascade Spring, "along the banks of a stream of warm water which

issued from several very large springs.”¹ “In the southern foothills Fall River and Cascade Creek . . . rise in large warm springs.”²

A survey of much material of the European *Adiantum Capillus-Veneris* shows the rhizome to be relatively thick and short, the whole rhizome measuring 1.5–5.5 cm. long and being densely covered with dark brown to blackish lanceolate or more slender scales. Except from the specimens and plates it is difficult to form a good impression of the European rhizome, European students assuming that, of course, everyone knows such details. From Linnaeus, Willdenow, Swartz, Schkuhr (who evidently thought it too well-known to illustrate), Hooker, Hooker & Baker and many others we get no idea of the rhizome. Some, such as the caustically critical (of others) James Britten, *Eur. Ferns*, 44 (1881), after saying “It is hardly necessary to describe at very great length so well-known and popular a fern as this”, allows it “a slowly creeping caudex, which is black and scaly, about as thick as a quill”; and Rouy, *Fl. France*, xiv. 389 concurs, with “Rhizome rampant, densément paléacé”; Luerssen, *Farnpfl.* 81 (1889) does better: “Rhizom kriechend, spärlich verzweigt, . . . im Breitendurchmesser bis 4–5 mm. stark”.

In the wide-ranging North American plant, occurring from Cuba and Florida across the southern United States, south into Mexico and north into southwestern Virginia, Kentucky, Missouri, South Dakota, Utah and southern California, the very slender and (when fresh) rather pale rhizome or caudex is elongate and, when not broken, shows a length of 0.5–1.5 dm., with the scales paler and fewer than in the typical European plant. Small well shows a portion of a rhizome in his *Ferns Se. States*, 120 (1938), and his description, p. 118, correctly says: “Rootstock horizontal, slender, creeping, with light-brown chaff.” Whereas in the European plant the fronds only exceptionally reach a height of 6 dm., that is nearly the average with us. D. C. Eaton in Chapman, *Fl. So. U. S.* 591 (1860), discriminating between stipe and frond or lamina, said: “Fronds 1°–3° [*i. e.* 3–9.1 dm.] long”; and in his *Ferns N. Am.* i. 283 (1879) he said “one of Professor Harvey’s fine specimens has a frond

¹ C. E. Bessey in *Bot. Gaz.* xxvi. 211 (1898).

² Arthur C. Mackintosh, *A Botanical Survey of the Black Hills of South Dakota in Black Hills Engineer*, xix. 161 (1931).

seventeen inches [5.18 dm.] long." With the stipe of about equal length, that means a total length of more than 1 m. Typical *Adiantum Capillus-Veneris* does not reach nearly that length.

The pinnules, too, show rather notable differences. In the European plant those of the sterile fronds are lobulate and deeply incised and commonly dentate, those of the fertile fronds commonly rounded above, only shallowly notched and scarcely to not at all toothed. In the American plant the pinnules are deeply cleft and lobed on both sterile and fertile fronds and in both they are sharply dentate, especially around the summit. The latter difference is rarely noted by those who treat the European and the temperate North American plants as identical. It was, however, detected by George Schneider, Bk. of Choice Ferns, i. 256 (1892), when he wrote: On the sterile fronds the "pinnules . . . deeply lobed from the circumference in the direction of the center, and the lobes again bluntly crenated (dentated) . . . and the lobes in the American form are usually denticulated (toothed), and sometimes very sharply so . . . In fertile fronds [in Europe], the teeth either disappear or are seen only on the upper part of the sides of the lobes". George Schneider detected a real difference which, although shown in carefully prepared drawings (like D. C. Eaton's) had been overlooked by his predecessors.

With several tendencies or truly significant characters separating the more widely spread plant of the United States from the typical plant of Europe, I propose to call the former

ADIANTUM CAPILLUS-VENERIS L., var. **protrusum**, var. nov., a var. typica recedit caudice stramineo vel brunneo elongato 0.5–1.5 dm. longo, 2–4 mm. crasso, sparse vel laxe paleaceo, paleis brunneis; frondibus (stipitibus inclusis) plerumque 0.3–1 m. longis; pinnulis laminarum sterilium fertiliumque acute dentatis.—Damp calcareous cliffs and sheltered slopes, Cuba and Florida to Texas, Mexico and southern California, north to southwestern Virginia, Kentucky, Missouri, South Dakota and Utah.

The following are characteristic:

CUBA: San Blas, Prov. Santa Clara, *Hunnewell*, no. 11,454.

VIRGINIA: near New River, 1879, *Schriver*.

GEORGIA: shaded lime-sink near Flint River, Dooly Co., *Harper*, no. 1064; lime-sink at Forest Falls, Decatur Co., *Harper*, no. 1193; shaded perpendicular cliffs, bank of Chattahoochee

River, Quitman Co., *Harper*, no. 1756; perpendicular rocky bank of Samochechobee Creek, Clay Co., October 29, 1902, *R. M. Harper*, no. 1791 (TYPE in Herb. Gray).

FLORIDA: rocks on Chipola River near Marianna, *A. H. Curtiss*, no. 6805; cliffs at Aspalaga, *Chapman*; Aspalaga Bluff, along Apalachicola River, Liberty Co., *Small, De Winkeler & Mosier*, no. 11,021; limestone rocks in seepage, along the Apalachicola River on Rock Bluffs, Aspalaga region, *Correll & Kurz*, no. 5674.

KENTUCKY: Burnside, Pulaski Co., *Jas. H. Ferriss*; waterfall near Bronston, Pulaski Co., *McFarland*, no. 66.

TENNESSEE: Lookout Mt., *A. H. Curtiss*, no. 3709.

ALABAMA: dripping rocks along Tennessee River northeast of Sheffield, Colbert Co., *Harper*, no. 3277.

MISSISSIPPI: Waynesboro, Wayne Co., *Pollard*, no. 1235.

MISSOURI: bluffs, Monteer, *Bush*, no. 1126; dripping rocks, Monteer, *Bush*, no. 5339; on dripping rocks, Branson, *Bush*, no. 5372.

ARKANSAS: limestone ledges, White River, Washington Co., Nov. 3, 1877, *F. L. Harvey*; dripping ledges, limestone bluffs of White River, near Calico Rock, Izard Co., April 27, 1929, *E. J. Palmer*, no. 35,570; on seepage, above Buffalo, Newton Co., *D. M. Moore*, no. 32,441.

(LOUISIANA: very doubtful; see explanation below.)

SOUTH DAKOTA: border of Cascade Creek, Aug. 25, *Bessey & Clements*; wet bank of brook, Cascade Spring, Fall River Co., *E. J. Palmer*, no. 37,464.

OKLAHOMA: on bank about a spring at head of canyon, 7 mi. ne. of Guthrie, Logan Co., *G. W. Stevens*, no. 3265.

TEXAS: S. Felipe de Austin, *Drummond*, no. 355; shaded limestone cliff, McKittrick Canyon, Culbertson Co., *Moore & Steyermark*, no. 3548; North Llano River, west of Roosevelt, Kimble Co., *Cory*, no. 6735.

UTAH: St. George, Washington Co., *Eggleston*, no. 14,764; seepage under ledges, $\frac{1}{4}$ mile east of Virgin, Washington Co., *Maguire*, no. 21,485; sandstone ledge near waterfall east of Auto Camp, Zion's Park, *Maguire*, no. 16,316.

ARIZONA: Lower Kanab Canyon, Colorado River, *Chas. D. Walcott*; under rocks, Ramsey Canyon, Huachuca Mts., *L. N. Gooding*, no. 731.

CALIFORNIA: on rocks, Canyon, about 1500 ft., Mt. Wilson, Los Angeles Co., *S. F. Blake*, no. 846; shaded calcareous seep, Palmer Canyon, alt. 2500 ft., San Gabriel Mts., Los Angeles Co., *L. C. Wheeler*, no. 248; Santa Barbara, Oct., 1880, *M. D. Stebbins*.

NEUVO LEON: saturated bank, Sierra Madre Oriental, alt. about 5000 ft., *C. H. & M. T. Mueller*, no. 706.

COAHUILA: Chojo Grande, 27 miles southeast of Saltillo, *Edw. Palmer*, no. 360; edge of upper canyon, Sierra de la Madera, Cañon del Agua, *C. H. Mueller*, no. 3249; cañon del Agua Grande, shade, on gypsum by water, *R. M. Stewart*, no. 3801.

TAMAULIPAS: vicinity of Victoria, alt. about 320 m., *Edw. Palmer*, no. 189; Ojo de la Agua Grande, Cerro Bamora, vicinity of El Milagro, *H. H. Bartlett*, no. 11,066.

SAN LUIS POTOSI: Rio Verde, *Edw. Palmer*, no. 35.

SONORA: Nacori, alt. 3750 ft., *C. V. Hartman*, no. 292; wet cliff, Cajón de la Higuera, near Moctezuma, *Stephen S. White*, no. 382.

In the citation of states Louisiana was left in doubt. In the Gray Herbarium there is only one specimen of *Adiantum Capillus-Veneris* from that state. This is a single fertile frond which is not of the American var. *protrusum*, but which closely matches the European plant with deeply cleft pinnules, which was described by Willdenow as *A. trifidum*, with which the Louisiana collection was identified. This sheet "EX HERB. C. H. DEMETRIO" bears in Demetrio's hand the statement: "Found only one plant among others collected by Rev. C. Niermann, Clinton, La. Collected by Rev. C. Niermann January 1893". In the Gray Herbarium there is also a portion of a manuscript (presumably sent to Gray) from the late John L. Riddell in which he specially emphasizes that "there being no limestone in the parts of Louisiana botanically explored, we have not yet met it in this state"; and in the *Catalogus Florae Ludovicianae*, AUCTORE. J. L. RIDDELL, M.D., CHEM. PROF. UNIV. LA. in New-Orl. Med. and Surg. Journ. viii. (May, 1852) Riddell listed for the state only *A. pedatum*. The Demetrio label says "only one plant". Most American collectors emphasize its local abundance on wet calcareous cliffs and shores. In view of the cultivation of various forms of the European plant it seems improbable that the "one plant" of the European variety was native in southeastern Louisiana.

In the Riddell manuscript above referred to that keen observer proposed our plant as a new but unpublished species. He sent a water-color drawing and 3 different pinnules but his efforts were unappreciated and opposite his description the late Sereno Watson wrote "*A. Capillus-Veneris*, L.!" Unfortunately the unpublished name given by Riddell cannot be taken up, especially since he had on the sheet one pinnule from the next variety

(apparently, judging from his note) from Texas. Two trivial names have been given within this variety. One was noted under *A. Capillus-Veneris* as follows: "The form **elongatum** Lemmon is an elongated form from Arizona".—Clute in Fern. Bull. xiv. 57 (1906). Just what was elongated was not explained. The other, *A. Capillus-Veneris*, forma *cristatum* Moxley in Am. Fern. Journ. ix. 27 (1919), is a very exceptional aberration "having the tips of the fronds more or less dichotomously forking and crested". Its name should not be taken up for the wide-ranging and crestless variety.

In *Adiantum Capillus-Veneris*, var. *protrusum* the fertile pinnules are obviously cleft or deeply lobed and with evident sharp dentation except where occupied by the sori. They are thin-membranaceous or almost filmy in texture and the larger ones range from 1–3 (av. 1.6) cm. broad. In the western interior of the United States and somewhat down the mountains of Mexico there is a smaller plant, with subcoriaceous or firm pinnules, "Rootstocks widely creeping, often 10–12 cm. long, covered with slender narrow pale brown scales; . . . leaflets 6–8 mm. wide, . . . mainly 3-lobed, the incisions narrow and very shallow", etc. This is *A. modestum* Underwood in Bull. Torr. Bot. Cl. xxviii. 46 (1901), "A plant related to *A. capillus-veneris* but differing from it in the smaller, less incised leaflets, their more rounded compact shape, in the fewer narrower sori, in the light-colored stalks to the leaflets, and in general habit.

"The European specimens of *A. capillus-veneris* are usually much more lacinate than the American, but in *A. modestum* the leaflets are barely trilobed with very shallow sinuses"—Underwood, *l. c.* In a large series of *A. modestum* the larger fruiting pinnules have a breadth of 5–14 (av. 8.5) mm., this about one-half the breadth in *A. Capillus-Veneris*, var. *protrusum*. Several American authors reduce it outright to the European plant, others maintain it as a species. To me the middle course, on account of numerous transitions, seems the proper treatment and I am calling it

A. CAPILLUS-VENERIS L., var. **modestum** (Underw.), stat. nov. *A. modestum* Underw. in Bull. Torr. Bot. Cl. xxviii. 46 (1901).—Colorado and Utah, south to northwestern Arkansas, Texas, New Mexico and Arizona and locally into Mexico.

The following collections well represent the plant:

COLORADO: Hot Springs, Ouray, August 4, 1894, *Jeanie I. W. Thacher*.

UTAH: St. George, alt. 2500 ft., April, 1888, *M. E. Jones*; West cliffs, crusted with alkali, St. George, *Goodding*, no. 793; wet rocks at 864 m., St. George, *Tidestrom*, no. 9250; along stream in canyon, Zion Park, Washington Co., *Maguire & Maguire*, no. 4711.

NEVADA: Las Vegas, *Goodding*, no. 2241.

ARKANSAS: wet rocks (Ordovician limestone), Sulphur Springs, Benton Co., *E. J. Palmer*, nos. 3788 and 19,060.

TEXAS: Buena Vista, about 4 mi. west of Alpine, Brewster Co., April 3, 1936, *Warnock*; wet beds of Nueces R., Pulliam, Zavalla Co., *E. J. Palmer*, no. 11,331.

NEW MEXICO: abundant on rocks and grassy points overhanging the water of North Spring River, Roswell, *F. S. Earle*, no. 261, TYPE and ISOTYPE in Herb. Gray; Piedra Pinta, 1852, without stated locality, *Chas. Wright*, no. 2123, PARATYPE, labelled *A. chilense* Kaulf.; wet places on limestone ledges, canyon east of road, foothills east of Cook's Peak, Luna Co., *McVaugh*, no. 8129; wet loam, alt. approx. 6600 ft., Kingston, Sierra Co., *O. B. Metcalf*, no. 1380.

ARIZONA: Bright Angel Trail, Grand Canyon of the Colorado, Cocomino Co., *Carl B. Wolf*, no. 3177; petrified springs, Littlefield, *Tidestrom*, no. 9238: on lime deposits below spring seepage, Monkey Spring, Jeffcott Ranch, nw. end of Canelo Hills, Santa Cruz Co., *W. S. Phillips*, no. 2873.

COAHUILA: Saltillo, common about shady springs and water-courses, *Edw. Palmer*, no. 71.¹

CHIHUAHUA: alt. about 1300 m., vicinity of Chihuahua, *Edw. Palmer*, no. 331.

DURANGO: San Ramón, *Palmer*, no. 77.

COLIMA: San Marcos, *M. E. Jones*, no. 497a.

As stated, many specimens are transitional between vars. *protrusum* and *modestum*, but the firmer texture and small and barely notched fertile pinnules and its restriction chiefly to the Cordilleran region of North America shows that var. *modestum* is truly a geographic variety, not a mere ecological state. On some Mexican sheets Weatherby suggested that this may be the *A. Schaffneri* Fournier in Bull. Soc. Bot. France, xxvii. 328 (? 1880). I have seen no material of the type-no. (*Schaffner*, no.

¹ Palmer noted that "in the market it is called 'Silantrillo', to be used to assist menstruation in females". Apparently the marketmen had an inkling that it is *Capillus-Veneris*.

64), but two other Schaffner nos. before me seem to be small plants of *A. Capillus-Veneris*, var. *protrusum*. Fournier's description was rather inconclusive:

L'Adiantum Schaffnerii a les pinnules de l'*A. Capillus Veneris*, mais les frondes courtes, à peine ramifiées et souvent même simplement pinnées, naissant très serrées sur un rhizome horizontal.

Several specimens were originally labeled as *A. emarginatum*, but the Pacific American plant which erroneously passed as *A. emarginatum* Hook. but which is now known as *A. Jordani* K. Müll. is quite different in its very strong veins, in its very long linear transverse (instead of short and lunate) indusia and in the larger flabellate-rotund pinnules.

In the Rocky Mountains, however, *A. Capillus-Veneris*, var. *modestum* has an exceptional form with large fertile pinnules as broad as in the more western *A. Jordani*. This is

Var. MODESTUM, forma **rimicola** (Slosson), stat. nov. *A. rimicola* Slosson in Bull. Torr. Bot. Cl. xli. 308, t. 7, fig. 1 (1914).—Larger fertile pinnules 1.5–2.4 cm. broad.—Little known but seemingly an extreme of var. *modestum*, with fertile pinnules as large as in var. *protrusum* and standing between these varieties.

SHRUBS OF MICHIGAN.—Under this self-explanatory title the Cranbrook Institute of Science has issued a very attractive and equally accurate volume,¹ the second edition, enlarged and brought to date. The work, most happily, coming from the hand of the late CECIL BILLINGTON, cannot fail to be authoritative, a most happy situation in these days of inaccurate and unsound books on trees, shrubs or other wild plants being rushed from the press. The descriptions are clear, the maps of ranges within the state of Michigan convincing and the line-drawings most helpful. Not only will all botanists of the Great Lakes area, professional or amateur, need the book. Everyone interested in the flora of the northeastern United States and southeastern Canada will want it.—M. L. F.

¹ CECIL BILLINGTON: *Shrubs of Michigan*, ed. 2, pp. vii + 339, 206 figs. Cranbrook Inst. Sci. Bloomfield Hills, Mich. \$4.50. 1949.

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